REVISED WORK PLAN

REMEDIAL DESIGN / REMEDIAL ACTION (RDRA) WORK PLAN FOR RESOLUTION OF DNAPL RELEASES

DETREX FACILITY
ASHTABULA, OH
DOCKET NO. V-W-98-C-450

Prepared for
Detrex Corporation
Ashtabula, OH

March 2006

URS

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URS

March 31, 2006

Submitted Via Federal Express

Ms. Terese VanDonsel
United States Environmental Protection Agency
Office of Superfund, Region 5
SR-6J
77 West Jackson
Chicago, IL 60604-3590

Subject: Remedial Design / Remedial Action Work Plan for
Resolution of DNAPL Releases
Detrex Source Control Area – Fields Brook Superfund Site
Detrex Corporation, Ashtabula, Ohio
Docket No. V-W-98-C-450

Dear Ms. VanDonsel:

On behalf of Detrex Corporation, URS Corporation (URS) has prepared two (2) copies of the enclosed *Remedial Design/ Remedial Action Work Plan for Resolution of DNAPL Releases for the Detrex Corporation Source Control Area* for submittal. This Work Plan has been prepared in accordance with your request dated September 19, 2005 that was received by Detrex on September 22, 2005. In addition, Detrex and URS personnel met with USEPA and Ohio EPA to discuss this plan on March 20, 2006. The requests made by USEPA for moving the proposed trench location closer to Fields Brook, additional sampling points and soil gas survey protocol have been included in the updated Work Plan.

Per your request, we have included an additional four (4) copies for distribution to the Fields Brook Action Group (FBAG). If you have any questions, please do not hesitate to contact me at 216.622.2432 or Detrex personnel.

Sincerely,

URS Corporation - Ohio

Martin L. Schmidt

Martin L. Schmidt, Ph.D. pmc
Vice President

Enclosure

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TABLE OF CONTENTS

TABLE OF CONTENTS

List of Figures

List of Acronyms

DNAPL	Dense Non-Aqueous Phase Liquid
DPT	Direct-Push Technology
DS	As in DS Tributary (not defined-Page 1-1)
FBAG	Fields Brook Action Group
PID	Photo Ionization Detector
QAPP	Quality Assurance Project Plan
RD/RA	Remedial Design / Remedial Action
ROD	Record of Decision
SVOC	Semi-Volatile Organic Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

List of Appendices

This RD/RA Work Plan is being submitted to USEPA to address the occurrence of DNAPL in the source area at the Detrex Facility in Ashtabula, Ohio. The following information is being provided as background information. During routine maintenance conducted by the Fields Brook Action Group (FBAG) in May 2005, a pooled dark liquid was encountered in locations at Fields Brook that were remediated during 2000/2001 in EU-8. The dark liquid was sampled and determined via laboratory analyses to have similar elemental characteristics as DNAPL, PCBs and heavy metals. This was in soil in the floodplain that was supposedly remediated during 2000/2001.

Upon review of FBAG's preliminary data in early September 2005, Detrex undertook an investigation of their own that was supervised by URS that included fifteen (15) test pits and twenty-one (21) geoprobes in an attempt to locate DNAPL movement. The results from this investigation did not identify any DNAPL in the lacustrine clay formation or on top of the underlying till layer.

On September 19, 2005, USEPA issued Detrex a Request for Work Plan for Resolution of DNAPL Release to Fields Brook. Detrex received this letter on September 22, 2005. The requested Remedial Design / Remedial Action (RD/RA) Work Plan is designed to verify the potential mechanism of transport and stop any identified movement of contamination in the future. In addition, the Work Plan is intended to identify short-term measures that would be put in place to stop a release as soon as possible and provide a schedule for long-term actions that would provide greater protection to Fields Brook. All actions are required to have a monitoring plan to assess the performance of the actions. Detrex prepared a Remedial Design / Remedial Action RD/RA Work Plan in response to USEPA's request dated September 19, 2005 and submitted it to USEPA on October 21, 2005.

Subsequent to the RD/RA Work Plan submittal, Detrex and URS personnel met with USEPA on December 13, 2005 to discuss the RD/RA Work Plan and aspects of the current DNAPL recovery program. Following this meeting it was agreed that a joint meeting with all parties would be scheduled. In addition, USEPA requested that Detrex prepare a "mini" Feasibility Study for DNAPL recovery enhancements and coordinate sampling of existing recovery trenches in Fields Brook.

Representatives from Detrex, FBAG, and USEPA met on February 8, 2006 to discuss DNAPL occurrences at the Fields Brook Site. On March 1, 2006, USEPA submitted a follow-up letter indicating that FBAG will be responsible for DNAPL issues in Fields Brook and Detrex will be responsible for DNAPL issues in the DS Tributary. USEPA met with Detrex on March 20, 2006 to further discuss the draft RD/RA Work Plan and review the proposed investigative scope for the Southern Area and DS Tributary Area. This revised version of the RD/RA Work Plan includes agreements reached during the March 20, 2006 meeting. In general, these agreements resulted in the following:

- Repositioning of the Interceptor Trench further south of the DNAPL source area (i.e. south of MW17 and 18);

- Additional geoprobes in the Southern Area and DS Tributary to better assess site conditions; and
- Evaluation of Active and Passive soil gas sampling techniques to support existing data regarding the extent of DNAPL in the source area.

1.1 REMEDIAL ACTIONS IN PLACE

The 1997 Record of Decision for Detrex Source Area included the following components to address DNAPL. The construction of a slurry wall to contain DNAPL, installation of a groundwater-collection trench to collect contaminated groundwater and installation of vacuum enhanced wells to collect pooled DNAPL. The slurry wall was to be installed downgradient of DNAPL source areas and the extraction wells were to be installed near the leading edge of DNAPL source areas.

The remedial components were installed during 2000 and 2002, which included the following: slurry wall, groundwater collection trench on-site and in DS Tributary and 12 extraction wells. Construction of the slurry wall and groundwater trench was completed in 2001. Operation of extraction wells began in 2002. Several wells have been exhibiting operational difficulties, and in 2005 a plan for modifying well construction was presented to USEPA. At this time USEPA has not provided comments to proposed recovery well modifications. Detrex submitted a Feasibility Evaluation to USEPA on March 20, 2006 that provided additional recommendations for enhancing DNAPL recovery.

1.2 OVERVIEW OF REMEDIAL DESIGN / REMEDIAL ACTION WORK PLAN FOR POTENTIAL DNAPL RELEASE

This Work Plan will discuss the two (2) areas of the site where additional data is needed to assess the historical and ongoing monitoring data that has been collected by Detrex. Based on discussions held with USEPA in 2006, Detrex will install an Interceptor Trench on the southern portion of the Detrex property to provide long-term protection of Fields Brook. The approach for determining the alignment of the trench is described in this Work Plan. The remainder of this Work Plan will discuss the RD/RA investigation proposed for the Southern Area and the DS Tributary Area. In addition, the Work Plan will provide RD/RA Field Sampling and Quality Assurance Project Plan (QAPP) procedures to describe data collection including the proposed active and passive soil gas sampling protocols. Proposed schedules are provided for Work Plan tasks for the Southern Area and the DS Tributary Area.

2.1 DESCRIPTION OF AREA

This section of the RD/RA Work Plan presents a discussion and description of short-term measures proposed to investigate and evaluate the potential for DNAPL to migrate to Fields Brook in the Southern Area of the facility.

The Southern Area component of this RD/RA Work Plan includes the entire southern half of the Detrex facility that lies between the operating portion of the facility and Fields Brook to the South. This area is shown on **Figure 2-1**.

2.2 SUMMARY OF EXISTING DATA

There are three (3) groundwater monitoring locations in this area that have been monitored during remediation. Locations are shown on **Figure 2-3**. Three (3) shallow monitoring wells have been sampled and include DETMW-11S, DETMW-18S, and DETMW-17S. Based on recent sampling from September 2005, wells MW-17S and MW-18S did not exhibit VOCs above detection limit and well MW-11S did not contain water and could not be sampled. Results from March 2006 indicate no VOCs were detected above limit. These results are similar to the original sampling initiated by Detrex in March 2005. In addition, a review of RI data indicates that in 1994, both the shallow and deep wells did not report VOCs or SVOCs were detected above analytical detection limits. These wells are screened at the interface between the lacustrine clay and till.

As requested by USEPA in December 2005, Detrex collected groundwater samples from monitoring wells 17D and 18D in January 2006. The initial sampling indicated low levels of trichloroethylene (TCE) detected at 26.1 ug/l and 1.71 ug/l, respectively. At this time, Detrex considers these low concentrations to be a result of cross contamination during water level measurement recording. Detrex will resample monitoring wells 17D and 18D after several purges of each well. If results do not show significant reduction or non-detect from 17D and 18D, Detrex will install a new deep downgradient well south of these locations.

In September 2005, Detrex, with URS oversight, initiated sampling using both test pits and geoprobes to collect soil and groundwater samples in portions of the Southern Area. The digging of trenches, sampling of soil and water, analyses of soil and water, and interpretation of data was all overseen by URS. Detrex submitted this data to USEPA on September 15, 2005. Results from the investigation indicated that DNAPL was not observed in the lacustrine clay soil, in any test pit, or geoprobe location. These results remain the same, as of October 18, 2005. Groundwater and soil samples collected from the upper clay in the Southern Area did not detect any VOCs or SVOCs. Elevated concentrations of VOCs and SVOCs were identified in subsurface soils at two locations along the current surface water collection ditch that passes through this area. This surface water flows into Detrex's retention pond where it is then treated in their storm water treatment system prior to discharge to Fields Brook. No free DNAPL was observed in any test trench. Sampling locations are shown on **Figure 2-2**.

According to information provided by FBAG and as shown in **Figure 8** of the FBAG Report, thirty-six (36) Geoprobe locations were drilled on the western portion of the Southern Area. Based on the PID readings shown in **Figure 11** of the FBAG Report, it appears that no elevated PID readings were reported on the Detrex property. The map shows that all elevated PID readings were in the floodplain area. In addition, **Figure 13** of the FBAG Report depicts potential erosional channels in the lacustrine clay. If these erosional channels were actual pathways for DNAPL movement, then it would be expected that elevated PID readings indicative of potential DNAPL or residual DNAPL would have been detected in this area. No soil samples were collected for analytical testing as a part of the FBAG investigation. Detrex also provided a comprehensive summary of existing soil groundwater and headspace sampling from both FBAG and Detrex investigation work to all participants during the February 8, 2006 meeting.

As a result of reviewing data collected by FBAG in the Southern Area and the associated lack of elevated PID readings on the facility, Detrex is convinced that there are no complete pathways for DNAPL to migrate from the source area located 1,500 feet north to Fields Brook and reach the locations where DNAPL and PCBs have been identified in Fields Brook.

2.3 PHASE I: ADDITIONAL DNAPL DELINEATION DATA / PRELIMINARY INTERIM MEASURES

Soil data collected from fifteen (15) test pits and twenty-one (21) Geoprobes by Detrex in September 2005, overseen by URS, indicate the lacustrine clay does not contain VOCs, SVOCs or any indication of DNAPL. Since the actual occurrence of DNAPL or DNAPL impacted soil/groundwater has not been identified, Detrex is proposing to collect additional DNAPL delineation data in the Southern Area to verify potential transport mechanisms and update the Site Conceptual Model. All sample collection and analyses will be overseen by URS. The purpose of collecting this data will be to determine the appropriate location and orientation of an interceptor trench that will be designed to cut off identified complete flow paths of potential future DNAPL migration toward Fields Brook. At a minimum the following sampling program is planned:

- Advance thirty-five (35) Direct-Push Technology (DPT) borings in Southern Area;
- 9 in western property to evaluate clay erosion channels identified by FBAG;
- 13 along collection trench alignment;
- 12 in area between DNAPL source and Fields Brook;
- Advance borings 5-10 feet into underlying till;
- Collect continuous samples and conduct PID headspace;
- Collect one soil sample from each DPT location at the highest PID reading or at top of FBAG identified the erosional lacustrine clay channels and/or underlying till;

- Install approximately twenty-two (22) temporary piezometers utilizing DPT and collect groundwater samples; and
- Install approximately three (3) staff gauges within Fields Brook between State Road and the Detrex Retention Pond.

Proposed DPT borings and temporary monitoring well locations are shown on **Figure 2-3.** The final locations for these respective monitoring points will ultimately be based on field observations; therefore, the locations depicted on **Figure 2-3** are approximate.

In addition to collecting new data, all existing piezometers and monitoring wells in the Southern Area will be measured for water levels and sampled for VOCs and SVOCs. Specific procedures for sampling are described in Section 4.0.

2.3.1 Approach to Soil Gas Sampling

During the February 8, 2006 meeting, USEPA requested that consideration be given to using soil gas sampling as an additional tool for evaluation of the extent of subsurface DNAPL impact and locating the position of the interceptor trench that is planned for the Southern Area of the Detrex Facility.

A soil gas survey has been proposed for the delineation of dissolved and free phase volatile organic compound (VOC) contamination at the Detrex facility. Based on URS' understanding of the site conditions and the current state of this technology, the following evaluation of this technology is presented.

2.3.1.1 Description of Active and Passive Sampling Techniques

Active and passive techniques are the two (2) widely used soil gas sampling protocols. The active method requires the advancement of a borehole to specific depths where an aliquot of soil vapor is collected in a sample container and submitted for analysis. The advantage of this method is that it can be used for vertical profiling, it provides semi-quantitative concentrations in soil in groundwater, it provides a "snap shot" of concentrations of VOCs and it provides precise mapping of contamination since the sample is collected from a small soil volume. However, since it collects a sample from a relatively small area, the sample must be collected relatively near the contamination for a detection to occur. This limitation requires the advancement of borings using drilling and very close spacing of sample locations. Additionally, active samples are less sensitive to low concentrations of VOCs than passive gas absorbents.

Passive sampling relies on an absorbent material that is placed at a relatively shallow depth to collect VOCs over a period of time. The nature of the collection protocol lends this technique to assessment applications where a high resolution of contaminant location and correlation with concentrations are not necessary. Sampling is conducted in two steps. In the first step, a hole is advanced to a depth as shallow as approximately 3 feet. An absorbent is suspended in the open hole and isolated from ambient air by the capping the hole. After approximately two weeks, the samplers are collected, sealed and analyzed offsite. The analysis is generally considered to

provide relative concentration data in the soil and groundwater that are applicable to an area of 15 to 30 feet from the sampling point. The success of this method is highly unpredictable since it relies on the migration of contaminated soil gas to the sampler through a highly variable soil matrix. Additionally, the gas migration is dependent on barometric pressure changes. These limitations are somewhat addressed by the duration of the sample collection, which provides a time weighted average of the VOC concentration.

2.3.1.2 Proposed Sampling Approach

Based on the soils at the site being characterized as relatively impermeable and the objective of this investigation to VOC plume for the placement of an interceptor collection trench, URS suggests the deployment of passive samplers in two phases. The initial phase would be used to verify the validity and sensitivity of passive sampling. The sampling sites would be spaced approximately 60 feet apart along a transect between monitoring well DETMW11S which is a "clean" well and DETMW10S which is within the area impacted by VOCs. Proposed locations are shown on **Figure 2-3**. In addition five (5) additional soil gas sampling locations will positioned south of the DNAPL source area. Each sampling site will be sampled in duplicate using two proprietary absorbents. Duplicate samplers will be advanced approximately 3 and 7 feet below ground surface. The boreholes will be advanced using a hand held drive device consisting of steel rod 1-inch in diameter. During installation of the boreholes that will contain absorbent material, active soil gas sampling will be performed to evaluate conditions at the time the absorbent is placed in the borehole. Active sampling will be performed by placing the PID intake tube into the borehole and allowing the PID to analyze the air space in the open hole. A PID with an 10.2 bulb will be used. URS suggests using absorbents marketed by W.L. Gore (Gore™ Modules) and Beacon Environmental Services (Emflux™). After approximately 10 days, the samplers will be removed, sealed and shipped to their respective vendors under chain of custody protocol for laboratory analysis. A copy of the standard operating procedures (SOPs) for the proposed soil gas sampling approach is included in Appendix A.

The outcome of this initial phase will be used to optimize the sampling protocol by identifying which sampler and which depth is most sensitive to the presence of the subsurface VOC plume under site conditions. Based on the outcome, the second phase will be developed. This phase will include a larger area of samples spaced over a grid that will overlay the suspected leading edge of the VOC plume.

2.4 PHASE II: PRELIMINARY DESIGN OF REMEDIAL ACTION INTERCEPTOR TRENCH

Detrex is planning to install a downgradient groundwater/DNAPL interceptor trench south of the DNAPL source area. The actual location of the trench will be based on soil and groundwater analytical data collected during Phase I. The trench will be located in a clean area that is close to the identified DNAPL source, in order to minimize potential future impacts down gradient to other clean areas of the Site and collect potential DNAPL close to the source. This down gradient interceptor trench, will be included as part of the long-term remedial measures for the Detrex Source Area remediation.

Considering existing monitoring data points, Detrex is proposing the following interim measure conceptual design for the proposed interceptor trench.

- Segment 1: South of DETMW17S and DETMW18S, depth 25 feet, extend into till, east-west orientation, length, approximately, 500 feet;
- Segment 2: Approximately 50 feet east of force main, depth 25 feet, extend to facility fence line, northwest-southeast orientation, length 800 feet; and
- Segment 3: Inside storm water collection basin, depth 15 feet, length 100 feet.

As described earlier, the position of the interceptor trench will be based on the results of alignment boring samples. It will be Detrex's intent to provide a subsurface cut off mechanism as close to the DNAPL source area as possible, so as not to extend the size of the potentially impacted area. Additional details of the conceptual design include:

- Depth of trench will vary, but will extend into the till layer a depth approximately of 1-2-feet;
- Trench will be sloped to facilitate water flow to central sumps;
- Recovered fluids from the trench will be pumped and treated on site;
- Total length of interceptor trench components will be approximately 1,400 feet.

A preliminary alignment of the interceptor trench and preliminary details showing construction of the trench are provided on **Figures 2-3** and **2-4**.

2.5 PROPOSED INTERCEPTOR TRENCH MONITORING PLAN

In order to monitor groundwater conditions near the alignment of the trench, several types of monitoring data will be collected. Actual locations will depend on the final alignment. Sampling will occur initially on a quarterly basis for the first year. The frequency of monitoring will be reduced to semi-annually depending on groundwater analytical results. Upon completion of the interceptor trench, a detailed monitoring plan will be submitted to USEPA. Anticipated monitoring may include the following:

- Existing monitoring wells MW-11S (if water is present), MW-17S/D, MW-18S/D;
- Five (5) monitoring wells/piezometers located downgradient of the source area will be selected for use as long-term monitoring locations;
- Periodic measurement of liquid levels in trench from clean outs and collection of water samples;
- Flow measurements obtained during pumping as required by NPDES modifications; and

- Periodic surface water elevations from staff gauges installed in Fields Brook.

2.6 SOUTHERN AREA REPORTING

Following completion of the Southern Area Supplemental Investigation and subsequent data evaluation, URS will prepare a report of findings. This Supplemental Investigation Report will provide a recommended alignment of the proposed interceptor trench, and provide a Detailed Design of the Remedial Action. In addition, soil and groundwater data will be evaluated and an updated Monitoring Plan for the interceptor trench components will be prepared.

2.7 SCHEDULE

Considering the need for supplemental information to verify transport mechanisms in the Southern Area, the following schedule is proposed:

Task Description	Date
Revised RD/RA Work Plan Submitted to USEPA	March 31, 2006
USEPA /Approval (2 weeks)	April 14, 2006
Southern Area Supplemental Sampling (4 weeks)	May 12, 2006
Remedial Design of Interceptor Trench (2 weeks)	May 26, 2006
Remedial Design Plans/Specifications to USEPA	June 9, 2006
Contractor Mobilization	Late June, early July 2006

2.8 LONG-TERM MEASURES PLAN

At this time it is not possible to identify the exact location of the Interceptor Trench. However, Detrex will locate the trench downgradient of dissolved-phased impacted groundwater. It is expected that when the Interim Measures trench is installed that it will also serve as the Long-Term Measures for the Southern Area.

This section of the Site RD/RA Work Plan presents a discussion and description of the short-term measures proposed to investigate and evaluate the potential for DNAPL to migrate to the DS Tributary either in on-site or off-site areas proximal to the Site.

Previous work in this area was described in *Technical Memorandum 3* (Woodward-Clyde, May 1997). This memorandum presented a Feasibility Study that identified several conceptual remedial alternatives for the Site. The USEPA selected Alternative No. IV in the Source Control Record of Decision (ROD), issued September 1, 1997, to address the environmental conditions identified at the Site. With respect to the DS Tributary Area, Alternative No. IV included:

- A downgradient vertical barrier wall (slurry wall) between the Site and off-site areas to the west;
- A groundwater collection trench upgradient of the slurry wall; and
- A groundwater interceptor trench beneath the DS Tributary.

Each of the above outlined items was subsequently addressed in the *Plans and Specifications for Remedial Design/Remedial Action Report*, dated February 17, 2000. A Remedial Action Work Plan for these and other site activities was issued to the agencies on August 28, 2000, and field work was initiated in September 2000. The slurry wall and remedial trench installations were completed and the DS Tributary Remedial System was placed into operation in 2001.

3.1 DS TRIBUTARY AREA DESCRIPTION

The DS Tributary Area, designated as Reach 11-3, is located in the northwest corner of the Site, and flows east to west along the northern Site property boundary where it exits the site through a culvert that passes beneath State Road. From this point, the DS Tributary flows to the west-southwest and eventually south where it enters into Fields Brook. The DS Tributary also approaches the Site from the RMI Facility, in the area located just north of existing monitoring well DETMW04S (see **Figure 3-1**). This area of the DS Tributary was not planned for sediment excavation during the original SOU Remediation. According to available documentation, a small quantity of sediment was removed from the DS Tributary in a location further downstream of State Road (FBAG Construction Completion Report).

Based on historical surface water drainage directions as well as groundwater flow direction, the potential for site-specific constituents and/or DNAPL to discharge to the DS Tributary was considered during the evaluation of remedial alternatives for the Site. The USEPA ultimately approved remedial measures for the entire Site, as well as remedial measures that focused on the DS Tributary Area. These remedial measures were outlined in the previous section, and consisted primarily of a slurry cutoff wall and concurrent groundwater remediation trenches. The general layout of the slurry wall and the passive groundwater collection system is shown in **Figure 3-1**. The location of the slurry wall was selected to be outside of the previously delineated dissolved phase groundwater impacts as well as the known presence of DNAPL in the subsurface. A low permeability vertical slurry wall was constructed outside of the leading edge of the dissolved phase plume along the western border of the Detrex Site, and was also extended beneath the active railroad spur and onto the RMI Sodium Property to the north. The slurry wall was installed

from ground surface through and into the interface between the lacustrine clay deposits and the underlying glacial till. In Spring 2005 a groundwater monitoring well was installed down gradient of the slurry wall to monitor groundwater elevations and quality. Results from sampling have not detected any VOCs at this time.

A groundwater collection trench was installed immediately upgradient of the slurry wall to a depth below groundwater, and the surface water elevation in the DS Tributary, in order to collect groundwater that could potentially mound behind the slurry wall. A groundwater interceptor trench was also installed beneath the east-west running portion of the DS Tributary, along the northern property boundary, to prevent the migration of groundwater into the DS Tributary. All groundwater collected in the two (2) trenches is routed via a gravity drain to a storm water pump station, for treatment through the Site's storm water treatment system prior to discharge. Additionally, a berm across the former drainage ditch that discharged to the DS Tributary was constructed to eliminate the direct discharge of surface water from the Site. It should also be noted that no DNAPL has been detected in the groundwater remediation trenches associated with the DS Tributary remediation system since operations began.

No free DNAPL was observed in any 2005 Geoprobe borings around the DS Tributary, particularly to the west of State Road in the area of the culvert that runs beneath the road. As a result, noted areas proximal to the DS Tributary will be a focus of the proposed supplemental investigation and data evaluation, as outlined in the following sections of this Work Plan.

3.2 DS TRIBUTARY AREA DATA GAP ASSESSMENT

In order to fully address the recent data related to DNAPL presence in the DS Tributary, as referenced in the September 2005 USEPA correspondence to Detrex, Detrex plans to complete an evaluation of the DS Tributary Area and the associated existing remediation system. This supplemental investigation was formulated based on the preliminary development of a data gap assessment. This proposed assessment is viewed as dynamic as it will be refined throughout the course of the evaluation, and will include, but not be limited to, a review of remedial operation, maintenance, and monitoring (OM&M) results of the groundwater remediation trenches and DNAPL recovery system.

At this time, the data gap assessment is estimated to include the completion of the following items:

- Review OM&M data generated for the groundwater remediation trenches
  - Integral sump operational set points
  - Designed operational groundwater elevation(s)
- Review OM&M data generated for the DNAPL recovery system
- Implement and evaluate additional OM&M data gathering efforts
  - Visual inspection of installed cleanouts and pump stations within the groundwater remediation trenches

  - Evaluation of groundwater levels within respective remediation trench access points (sumps, cleanouts), if possible
  - Visual inspection of the DS Tributary inlets and outfalls in the area
- Evaluate surface water levels (elevations) within the DS Tributary
  - Develop conceptual model of surface water – groundwater flow dynamics in the area of the groundwater remediation trenches
  - Visual inspection of installed cleanouts and pump stations within the groundwater remediation trenches
  - *Installation of staff gauges at strategic locations within the DS Tributary*
- Evaluate the FBAG and USEPA referenced DNAPL areas within the northwest corner of the Site in the area of the DS Tributary
  - Complete direct push borings to evaluate the subsurface for the presence of DNAPL
  - Install temporary piezometers, as necessary, to aid in the evaluation of the groundwater flow regime

The execution of the data gap assessment will serve to verify or supplement the current understanding of the conceptual site model and is integral to the development of potential remedial system enhancements, either spatial or operational, to the existing DS Tributary Area remedial system

3.3 DS TRIBUTARY AREA INVESTIGATION AND DATA EVALUATION

As described in the previous section and based on the reported DNAPL presence in the DS Tributary, Detrex will implement a focused supplemental investigation. The objectives of this investigation are:

- To verify the potential presence and source of DNAPL reported in the DS Tributary;
- To evaluate the surface water – groundwater hydraulic regime in the DS Tributary Area;
- To identify or dispel possible migration pathways and migration potential for DNAPL at the Site;
- To verify the subsurface conditions with respect to the existing conceptual site model
  - Geologic
  - Hydrogeologic
  - DNAPL
- To refine the OM&M of the current DS Tributary Area remedial system and determine if potential remedial upgrades or additions are required

The supplemental investigation that has been developed for the DS Tributary Area includes the installation of staff gauges within the DS Tributary, completion of direct push technology (DPT)

soil borings, and installation of temporary piezometers utilizing DPT. **Figure 3-2** presents the locations of the proposed staff gauges, DPT borings, and temporary piezometers.

The staff gauges will be installed within the DS Tributary in a manner that does not cause flow restrictions and anchored appropriately to facilitate future measurement of water elevations within the tributary, in order to permit ongoing data evaluations. Following installation, the respective staff gauges will be surveyed utilizing the existing datum for the Site. Approximately five (5) staff gauges are proposed for installation at the locations depicted in **Figure 3-2**.

Approximately twenty (20) DPT borings are proposed for the DS Tributary Area, in order to confirm the current understanding of the subsurface conditions (**Figure 3-2**). The final locations for these respective monitoring points will be ultimately based on field observations; therefore, the locations depicted on **Figure 3-2** are approximate. As requested by USEPA, five (5) additional DPT locations have been included north of the DS Tributary and adjacent to State Road. Soil and groundwater sampling will be completed within each DPT boring. The DPT borings will be advanced utilizing a continuous sampling system in order to comprehensively evaluate the subsurface stratigraphy. The field screening of soil samples will be completed following a standardized field headspace analysis procedure. Details are provided in Section 4.0.

The results of the headspace screening and observations made on the stratigraphic materials, occurrence of groundwater, and presence of DNAPL within respective test borings will serve as the guidance for the selection of soil samples to be submitted for VOC and SVOC laboratory analysis (see Section 4.0). It is estimated that one (1) soil sample from each DPT boring will be submitted for analytical testing. All completed DPT borings not utilized for temporary piezometer installations will be backfilled with bentonite.

Groundwater sampling will be completed for each DPT boring location, utilizing standard DPT hydropunch or equivalent, in order to verify the current conceptual site model and provide for detailed data on the nature and occurrence of dissolved phase constituents in the DS Tributary Area. The specific depth interval will be based on the observations determined during completion of the respective DPT borings. Should the hydropunch not be able to be deployed in the completed DPT boring, the hydropunch will be advanced to the selected depth interval immediately adjacent to the completed DPT boring. DPT sampling will be completed by either low-flow pumping utilizing dedicated, disposable tubing or a decontaminated bailer, depending on the selected sampling depth. At this time, it is estimated that one (1) groundwater sampling interval will be selected for each DPT boring. Groundwater samples will be submitted for VOC and SVOC laboratory analysis (see Section 4.0).

Temporary monitoring wells are proposed for thirteen (13) of the twenty (20) DPT locations, as noted on **Figure 3-2**. The intent of these temporary monitoring wells is to permit groundwater elevation measurements over time and periodically monitor COCs in groundwater. These data will be utilized in conjunction with the staff gauge levels in order to effectively evaluate the surface water / groundwater interaction, as well as the groundwater flow regime dynamics in the immediate vicinity of the DS Tributary Area remediation system. At this time, URS anticipates that the temporary monitoring wells will be constructed utilizing standard DPT pre-packed well materials. Following installation, the temporary piezometers will be developed until relatively

clear, sediment-free groundwater is produced, to the extent practical. Each of the DPT boring locations will be surveyed to the current site datum.

In addition to these intrusive activities, URS plans to complete a DNAPL Mobility Evaluation in order to verify the conceptual site model and current understanding of the DNAPL present in the subsurface and reported in the DS Tributary, referenced in recent USEPA correspondence. This evaluation includes a determination of the potential for DNAPL to migrate, laterally and vertically, under stable and dynamic conditions at the Site. In order to complete this evaluation, site-specific data will be required. These data will be either furnished through review of the existing site database or supplemented with data from the proposed supplemental investigation. The site-specific data required for this evaluation includes:

- Potentiometric data;
- DNAPL gauging data;
- Thorough review of site boring logs and descriptions of geologic materials;
- DNAPL physical property data (density, viscosity, interfacial tension);
- Grain size distribution testing for each identified geologic material; and
- Hydrogeologic testing data.

If warranted, based on the findings of the supplemental investigation, the DNAPL Mobility Evaluation will be completed, provided sufficient data is available. If completed, this evaluation will be utilized to supplement the current conceptual site model and potentially serve to:

- Determine the current potential for DNAPL migration at the Site in static and dynamic areas of the Site;
- Determine or validate design criteria for potential and/or existing DNAPL recovery locations; and
- Determine operational recommendations for existing or potential future DNAPL recovery locations to prohibit potential adverse DNAPL mobilization / migration.

The overall supplemental investigation is anticipated to require approximately one (1) month of field work initially, with the periodic collection of subsequent data from established monitoring points, staff gauges and temporary monitoring wells, continuing in the following three months. The data generated initially and over time will be incorporated into the existing conceptual site model and utilized to develop short- and long-term remedial modifications or additional remedial actions for the DS Tributary Area.

3.4 DS TRIBUTARY AREA REPORTING

Following the completion of the DS Tributary Area Supplemental Investigation and subsequent data evaluation, URS will prepare a report of findings. This Supplemental Investigation Report will provide recommendations on interim or short-term remedial measures necessary to address the noted DNAPL presence in the DS Tributary, if warranted.

URS will continue data evaluations and conceptual site model revisions utilizing the expanded monitoring network in order to develop a long-term strategy for the DS Tributary Area, as necessary. This will be documented in a separate submittal that will include a discussion of the completed data evaluation activities, as well as recommendations for remedial modifications or additional remedial measures, if necessary, to the current DS Tributary Area remediation system.

3.5 SCHEDULE

Considering the need for supplemental information to address potential data gap assessment issues in the DS Tributary Area, the following schedule is proposed.

Task Description	Date
Revised RD/RA Work Plan Submitted to USEPA	March 31, 2006
USEPA Approval (2 weeks)	April 4, 2006
DS Tributary Supplemental Sampling (4 weeks)	May 12, 2006
DS Tributary Investigation Report (2 weeks)	May 26, 2006
On-going Continued Monitoring (3 months)	September 2006
Remedial Design of DS Tributary Modification	September – October 2006

3.6 SHORT-TERM / LONG-TERM MEASURES PLAN

As described, additional site-specific data will be collected for the DS Tributary Area, in order to verify or rule out DNAPL movement. Upon review of the data collected and the results from monitoring, a Proposed Remedial Design for Short-Term / Long-Term modifications to existing components will be developed.

4.1 EXPLORATORY BORINGS AND SOIL SAMPLING

Prior to commencement of field operations, the Ohio Utilities Protection Service (OUPS) will be contacted regarding the presence and location of underground utilities. Additionally, all boring locations will be reviewed and cleared by Detrex personnel familiar with Site operations.

Detrex proposes to advance approximately thirty-five (35) DPT soil borings within the Southern Area proximal to and along the proposed interceptor trench alignment. Additionally, Detrex proposes to advance approximately twenty (20) DPT soil borings in the DS Tributary Area. All direct push boring activities will be performed by a pre-qualified operator. A qualified geologist will visually monitor the DPT operations and collect, classify and log soil samples using the United Soil Classification System (USCS) in accordance with American Society of Testing and Materials Method D2488-00 (ASTM, 2000). Proposed soil boring locations are presented in **Figures 2-3 and 3-2**.

Soil borings will be advanced using a hydraulically-driven, direct-push equipment (truck-mounted Geoprobe® Model 5400) per ASTM Method D6282-98 (ASTM, 1998). Samples will be continuously collected in 4-foot intervals using a large-bore, dual-tube, stainless-steel sampler. The sampler will be lined with dedicated, vinyl acetate liners. The sampler will be pushed to the desired depth, and then retrieved. Upon retrieval from the sampler, the soil samples will be divided into 2-foot intervals for description and screening. The borings will be advanced to the top of the till clay unit to approximate depths ranging from 20 to 30 feet below ground surface (bgs).

Before advancing each soil boring, all drilling and sampling equipment in contact with soils will be cleaned with a pressurized, hot water sprayer. During sampling operations, sampling equipment will be cleaned using a non-phosphate detergent wash and a potable water rinse. Drilling and sampling equipment will be allowed to air dry following decontamination.

Borehole cuttings will be placed into 55-gallon drum and stored at a location designated by Detrex personnel. All work will be supervised by a URS representative.

4.2 FIELD SCREENING PROCEDURES

A 10.6 eV photo ionization detector (PID), manufactured by Rae Systems will be used to screen for the presence of VOCs in the headspace of soil samples. One soil sample will be submitted for laboratory analysis from each boring. Sample selection will be based on headspace screening results and proximity to the top of the clay and till layers. The sample with the highest head space reading will be submitted to the laboratory for analyses. If field conditions suggest elevated headspace reading in other depths, additional samples may be collected. The MiniRae will be calibrated as described in the Rae Systems *Instructions and Service Manual* using 100 parts per million (ppm) isobutylene. Calibration results will be recorded in the field logbook.

Headspace screening of soil samples will be conducted in the field in the following manner:

- After sample collection, each sample will be split in half. One-half is placed in a laboratory-supplied, 4 ounce glass container and with a Teflon-lined lid and placed in an iced cooler for potential submittal for laboratory analysis. The jar will be filled so that no head space is visible in the container.

- The other half is placed in a re-sealable plastic bag, sealed and vigorously shaken.

- Following a period of approximately 10 minutes for accumulation of organic vapors, the re-sealable plastic bag is again shaken. The MiniRae probe is inserted through a small opening in the plastic bag. The highest organic vapor concentration in the headspace of each sample container is then measured and recorded in the field log book.

- After screening, the portion of the sample subjected to headspace screening is placed with the borehole cuttings for disposal.

4.3 SAMPLE IDENTIFICATION

All analytical samples will be assigned a unique sample identifier. The identifier will be comprised of the following information:

- Sample Location (DPT identification number, (i.e., DETGP-101),

- Sample Interval, Depth (02-04),

- Sample date , and

- Sample type (Environmental, Replicate, or Trip Blank).

4.4 LABORATORY ANALYSIS OF SOIL SAMPLES

Soil samples shall be analyzed for COCs pursuant to the following Methods:

- Volatile Organic Compounds (VOCs) by USEPA Test Method 8260
- Semi-Volatile Organic Compounds (SVOCs) by USEPA Test Method 8270

Samples will be shipped to Firstech Laboratories of Cleveland, Ohio in an insulated cooler with ice under standard chain-of-custody protocol.

4.5 TEMPORARY GROUNDWATER MONITORING WELL INSTALLATION AND DEVELOPMENT

Up to thirty-five (35) temporary monitoring wells will be installed in the designated soil borings (22 Southern Area, 13 DS Tributary Area). Monitoring well installation activities will be performed in accordance with ASTM Method D6724-01 (ASTM, 2001). The monitoring wells will be constructed of 1-inch diameter, flush-threaded poly-vinyl chloride (PVC) pipe to depths

ranging from 20 to 30 feet bgs. This depth is an estimate and the final depth will be considered based on field observations. Ten feet of 0.010-inch slotted, pre-packed, PVC well screen will be installed in all of the wells. A 2-foot thick, bentonite seal will be placed above the screened interval of each well and hydrated with potable water. The remainder of the annular space will be backfilled with a bentonite/cement slurry. Temporary wells will be secured with a threaded PVC cover. Proposed temporary monitoring well locations are presented on **Figures 2-3 and 3-2.**

Monitoring wells will be developed by the removal of up to 10 well-casing volumes of water with small-diameter, dedicated, high-density polyethylene (HDPE) bailers. Each well volume removed will be field-tested for temperature, pH, and conductivity using a field water quality meter. Well development will be determined to be complete when the three consecutive readings of water quality parameters have stabilized to within 10%. Well development data will be recorded in the field log book.

Monitoring well development water will be temporarily stored in 55-gallon drums until it can be processed through the Detrex water treatment system and discharged under existing NPDES permits.

4.6 SITE SURVEYING

An elevation survey will be conducted using a surveyor's level. The top-of-casing elevations of monitoring wells and the ground surface elevations will be surveyed and referenced to the site benchmark that is consistent with previously completed site investigations.

4.7 GROUNDWATER MONITORING

All groundwater samples will be collected using disposable, high-density polyethylene bailers. This technique involves sampling groundwater by purging the well by lowering the bailer into the water column and removing groundwater from the well until the water quality parameters have stabilized.

The following information will be recorded in the field log book at each groundwater sampling location:

- Date and time;
- Barometric conditions, temperature, and general weather conditions;
- Depth to water measured from the surveyed top of the well casing;
- Depth to the top of DNAPL (if any); and
- Depth to bottom of well measured from the surveyed top of the well casing.

A standard electronic water level indicator will be used to take the measurements for locations located outside of the DNAPL impacted area. Additionally, the wells will be measured in order from least impacted to most impacted. This determination shall be made based on the most current groundwater analytical results. The water level indicator will be decontaminated between each well as specified in Section 4.8.

DNAPL measurements will be collected utilizing a dedicated interface probe, which is capable of measuring the top of the water column, as well as, the top of the DNAPL layer (if present). Due to the difficulty in adequately decontaminating the interface probe, it will only be used in monitoring wells that routinely contain DNAPL. Monitoring wells located outside the DNAPL plume area will be assessed for the presence of DNAPL by lowering a bailer to the bottom of the well during each quarterly sampling event. Visual observations will be recorded in the field log book.

On the basis of the above measurements and well diameter, the volume of water standing in each well will be calculated. Well purging will be conducted by lowering the dedicated one-time use HDPE bailer into the well. Prior to initiating the well purging and after each well volume, the discharge water will be measured for specific conductance, pH and temperature. All purge water will be containerized and processed through the Detrex water treatment system in accordance with federal, state and local regulations.

Sample collection will commence after at least three well volumes have been purged or parameters (temperature, pH, and specific conductance) have stabilized (defined as 10 percent or less parameter fluctuation between two successive measurements). If the well is purged dry or is purged such that the full recovery period exceeds 2 hours, the well will be sampled as soon as a sufficient volume of groundwater has accumulated in the well to allow the collection of the necessary groundwater samples.

Sampling will be performed using the same equipment as that used for purging. All field measurements will be documented in the field logbook:

- At each location, groundwater samples will be collected for VOCs and SVOCs, as required;
- After the groundwater parameters have stabilized or after a minimum of three well volumes have been purged from the well, samples will be directly poured into laboratory supplied glassware; and
- Samples will be immediately placed in an iced cooler and maintained at a temperature of 4 degrees Celsius or lower, without freezing until they are delivered to Firstech Laboratories of Cleveland, Ohio under standard chain-of-custody protocol.

With the exception of the detergent that will be used for the initial cleaning, the solutions used to decontaminate the field equipment will not be re-used. All spent solutions will be containerized and processed through the Detrex water treatment system in accordance with federal, state and local regulations. Disposable equipment will be contained in a plastic garbage bag for disposal as solid waste.

4.8 DECONTAMINATION PROCEDURES

All sampling equipment to be utilized will be one time use and will be processed following use at each well. The water level indicator and the interface probe require decontamination prior to use at each location. The entire length of cable that comes into contact with groundwater or DNAPL will be decontaminated in the following manner:

- The equipment will be rinsed with clean potable water;
- Followed by an Alconox/water solution rinse;
- Followed by a deionized water rinse.

If DNAPL is encountered the equipment will be rinsed with Methanol following the Alconox/ water solution rinse.

4.9 SAMPLE IDENTIFICATION

All analytical samples will be assigned a unique sample identifier. The identifier will be comprised of the following information:

- Sample Location (monitoring well identification number, (i.e., DETMW-04S);
- Sample date ; and
- Sample type (Environmental, Replicate, or Trip Blank).

4.10 SAMPLE HANDLING AND PACKING

Samples will be collected in order and containerized according to the volatility of the target analytes. The collection order for the analytes is as follows (where applicable):

- Volatile organics (VOAs or VOCs); and
- Semivolatile organics (SVOCs)

Immediately following collection, samples will be placed in iced, insulated coolers. Samples will be packed in bubble wrap or equivalent material, placed in iced, insulated coolers and shipped to the approved laboratory via overnight courier. Proper chain of custody will be maintained during sample handling and shipping activities.

4.11 QUALITY ASSURANCE/QUALITY CONTROL

QC samples will be collected at the following frequencies:

- Field Duplicates (D) – One (1) per 10 environmental samples collected or a minimum of one per sampling event:

- Field Blank Samples (B) – One (1) per 20 environmental samples collected;
- Trip Blank Samples (TB) – One (1) trip blank will be included in each cooler containing samples for VOC analysis;
- Organic Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples – One (1) per 20 environmental samples collected; and
- Inorganic Matrix Spike/Laboratory Duplicate (MS/LD) Samples – One (1) per 20 environmental samples collected.

4.12 EQUIPMENT CALIBRATION

Instruments used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Field measurement instruments will include one or more of the following: multi-parameter meter, pH meter, specific conductance meter, thermometer (or temperature probe), and electronic water-level indicator. As a rule, each field measurement instrument will be calibrated daily prior to use and the calibration checked every 15 samples.

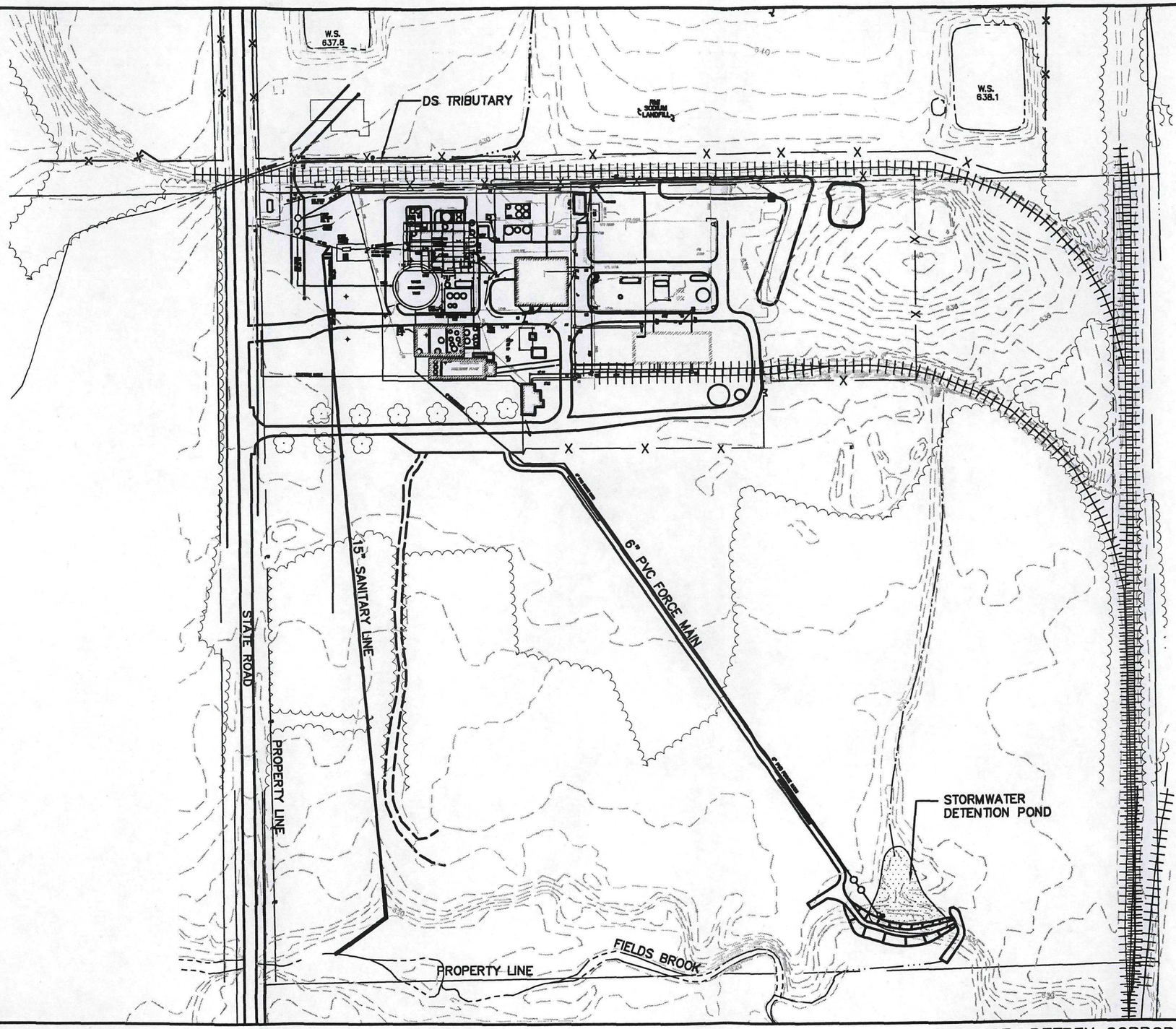
Calibration procedures will be documented in the field records. Documentation will include the date and time of calibration, the identity of the person performing the calibration, the reference standard used, the readings taken, and any corrective action.

4.13 SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS

The following table presents the sample container, preservation and holding time requirements:

Analysis Method	Sample Container	Preservative	Holding Time
SW846-8260B (VOCs) aqueous	Three 40-ml glass vials with Teflon-lined caps	No headspace HCL to pH<2 Ice (4°C)	14 days from time of collection
SW846-8260B (VOCs) soil	Two 4-oz glass with Teflon lined caps	No headspace Ice (4°C)	14 days from time of collection
SW846-8270C (SVOCs) soil	Two 4-oz glass with Teflon lined caps	Ice (4°C)	7 days from time of collection
SW846-8270C (SVOCs) aqueous	Two 1-liter amber glass bottles with Teflon-lined caps	Ice (4°C)	7 days from time of collection

Figures



URS

0 100 200 400

APPROXIMATE SCALE IN FEET

PROJECT DETREX CORPORATION
SUBJECT SITE LOCATION MAP
SCALE 1"=200'

JOB NO. 13810732
DATE 3/24/2006
DRAWN BY VD
FIGURE 2-1

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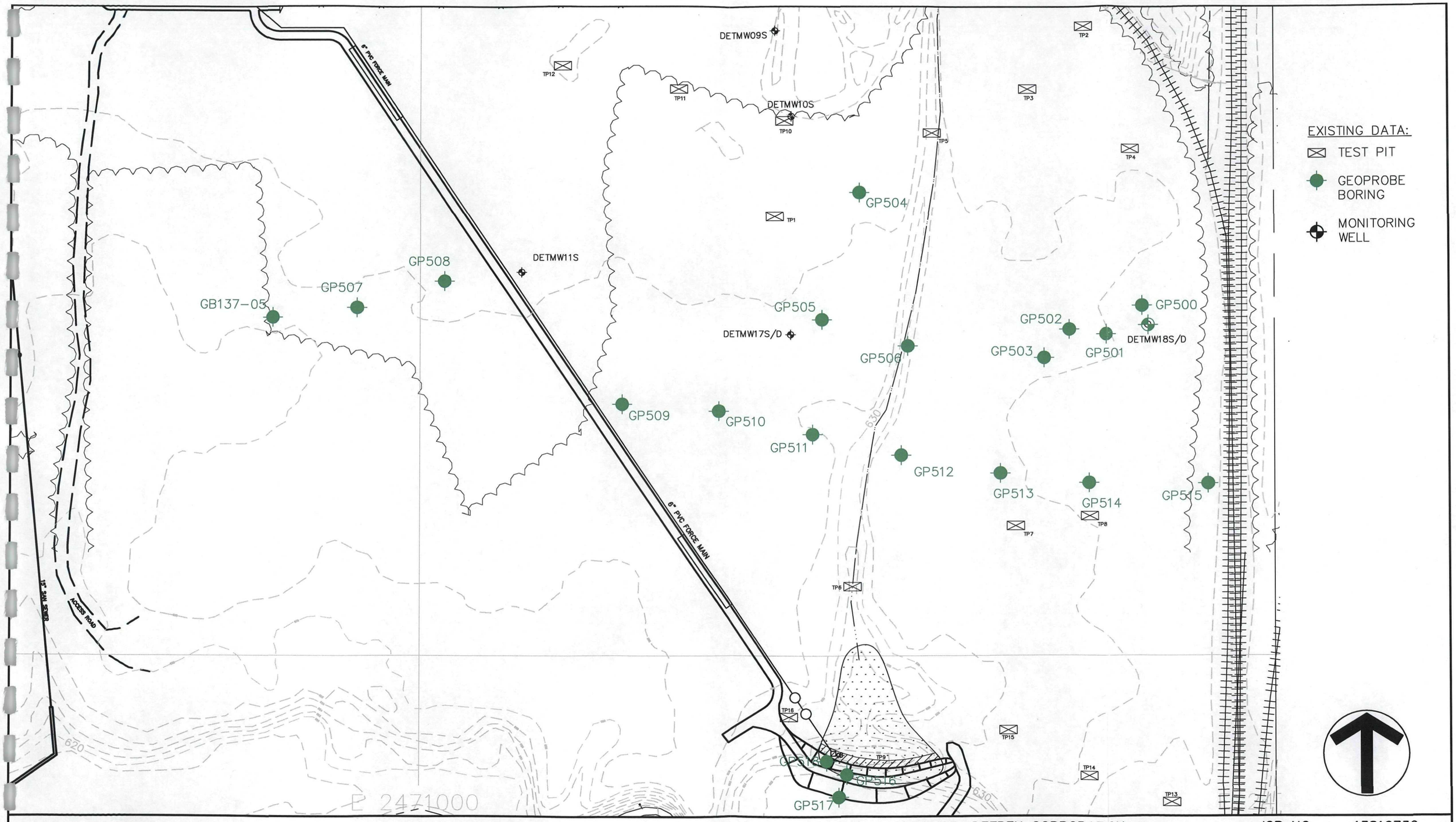


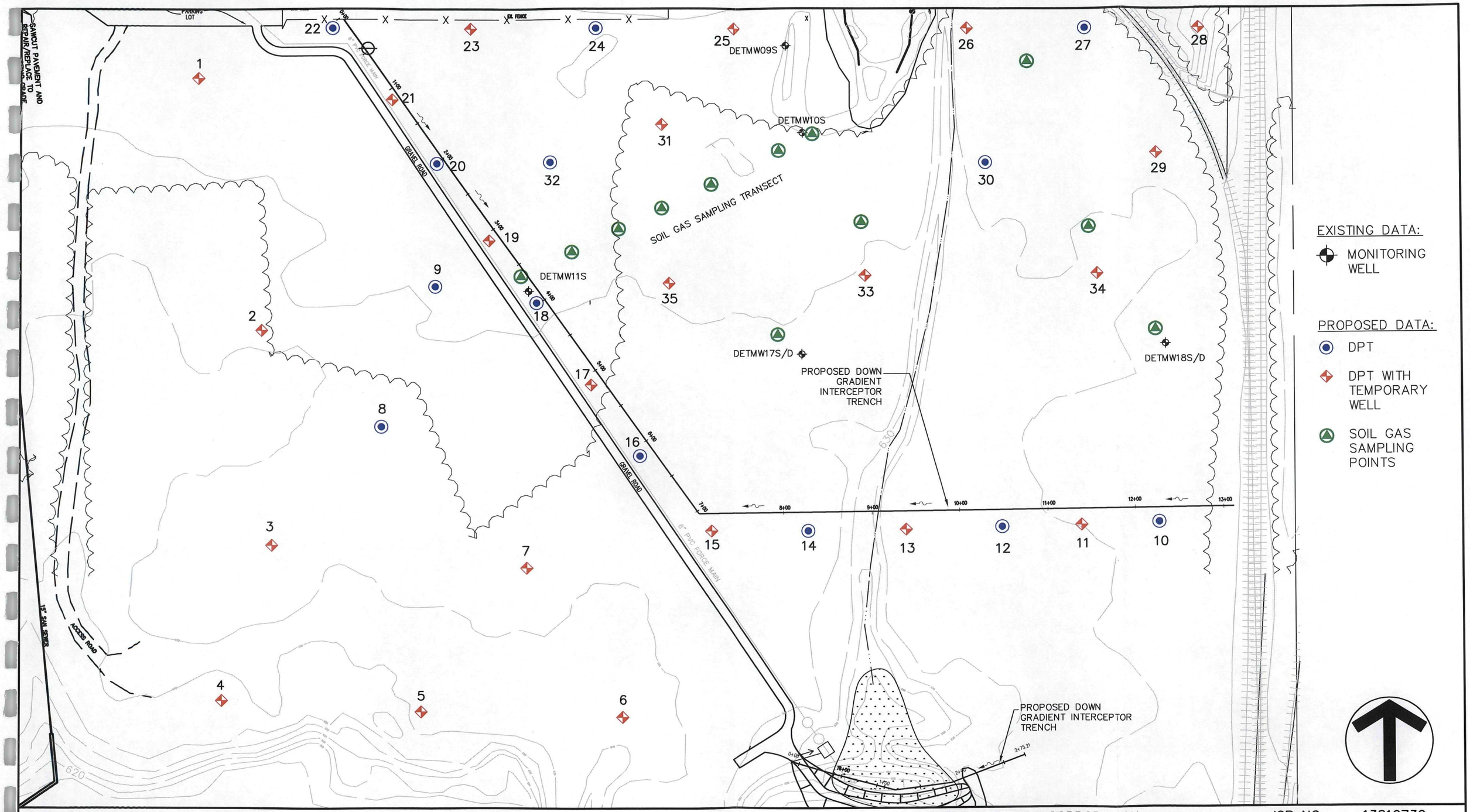
URS

0 50 100 200

APPROXIMATE SCALE IN FEET

PROJECT	DETREX CORPORATION	JOB NO.	13810732
SUBJECT	SEPTEMBER 2005 INVESTIGATION	DATE	3/24/2006
		DRAWN BY	VD
SCALE	1"=100'	FIGURE	2-2

P: \D\Detrex\13810732\DWGs\Figures\FIG2-2.dwg User: vari Mar 30, 2006 - 11:57am

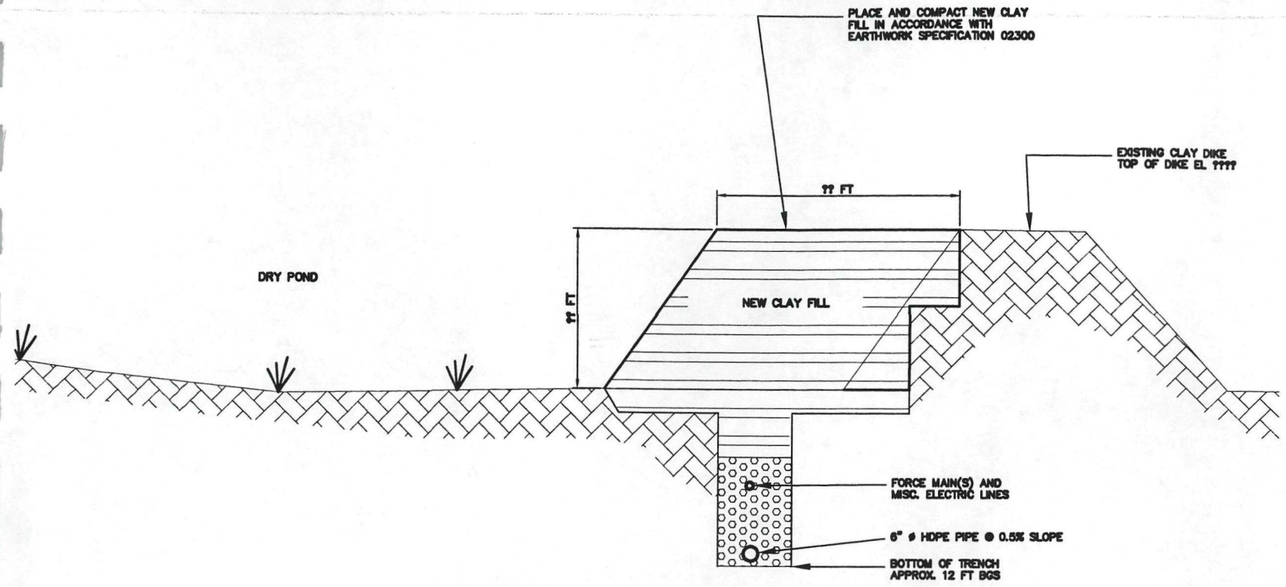


NOTE:
ALIGNMENT TO BE DETERMINED BASED ON ANALYTICAL DATA FOR SOIL/GROUNDWATER

0 50 100 200
APPROXIMATE SCALE IN FEET

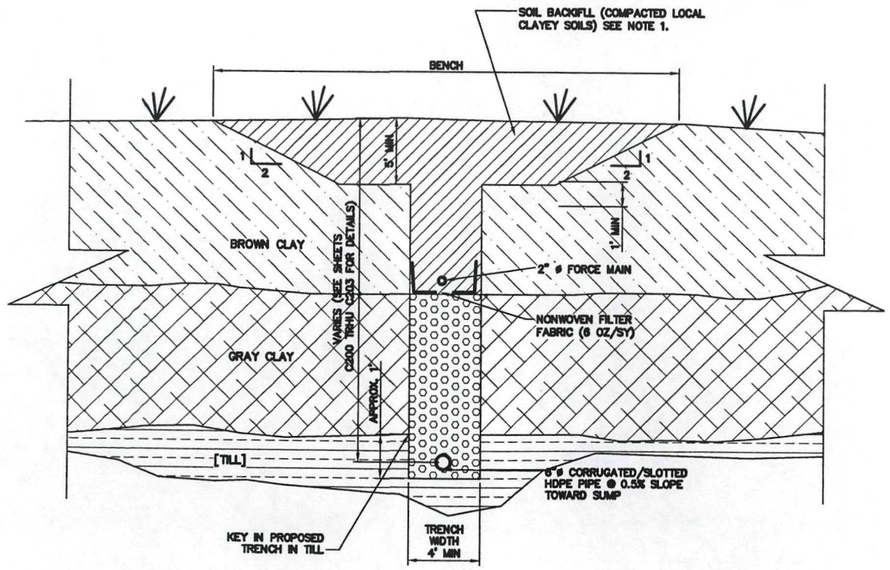
PROJECT	DETREX CORPORATION	JOB NO.	13810732
SUBJECT	PROPOSED SAMPLING LOCATION DOWN GRADIENT INTERCEPTOR TRENCH	DATE	03/24/2006
		DRAWN BY	KHN
SCALE	1"=100'	FIGURE	2-3

P:\D\Detrex\13810732\DWGs\Figures\FIG2-3.dwg User: vari Mar 30, 2006 - 11:53am



TYPICAL TRENCH CROSS SECTION

NOT TO SCALE



POND AREA TRENCH CROSS SECTION

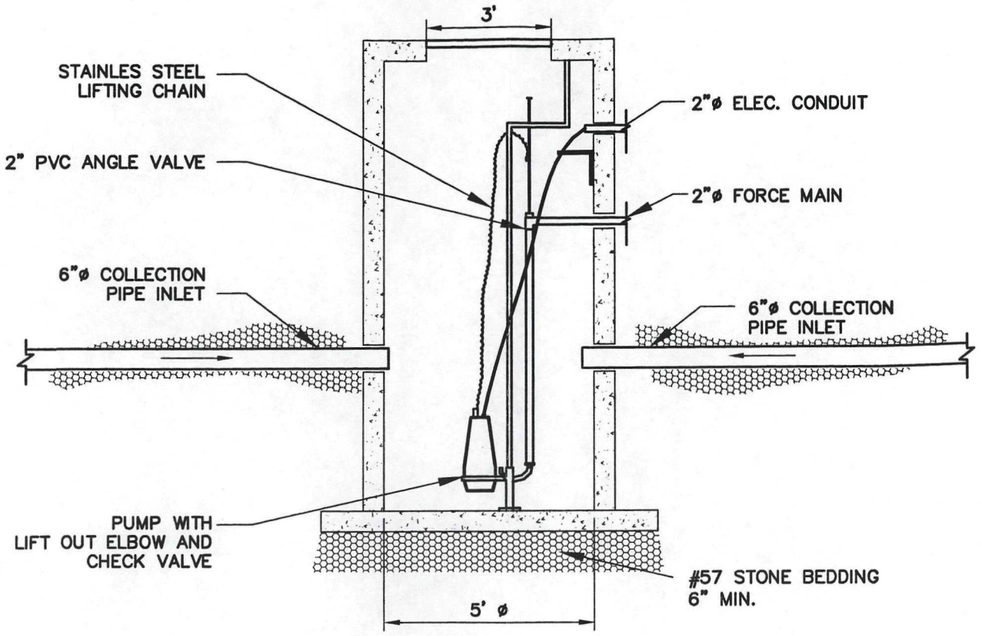
NOT TO SCALE

LEGEND:

- BROWN CLAY
- GRAY CLAY
- TILL
- GRANULAR BEDDING (#57)
- SOIL BACKFILL

NOTES:

1. SOIL EXCAVATED FROM TRENCHES/BENCHES TO BE STOCKPILED ON UPSLOPE SIDE OF TRENCH. CLAY TO BE RECOMPACTED IN TRENCH/BENCH AREA AND RESEEDED.
2. TRENCH WIDTH OF MINIMUM 4 FT AND SUFFICIENT TO INSERT TRENCH BOX AS NECESSARY.



TYPICAL SUMP DETAIL

NOT TO SCALE

URS

PROJECT	DETREX CORPORATION	JOB NO.	13810732
SUBJECT	DOWN GRADIENT INTERCEPTOR TRENCH DETAILS	DATE	3/24/2006
		DRAWN BY	VD
SCALE	NOT TO SCALE	FIGURE	2-4

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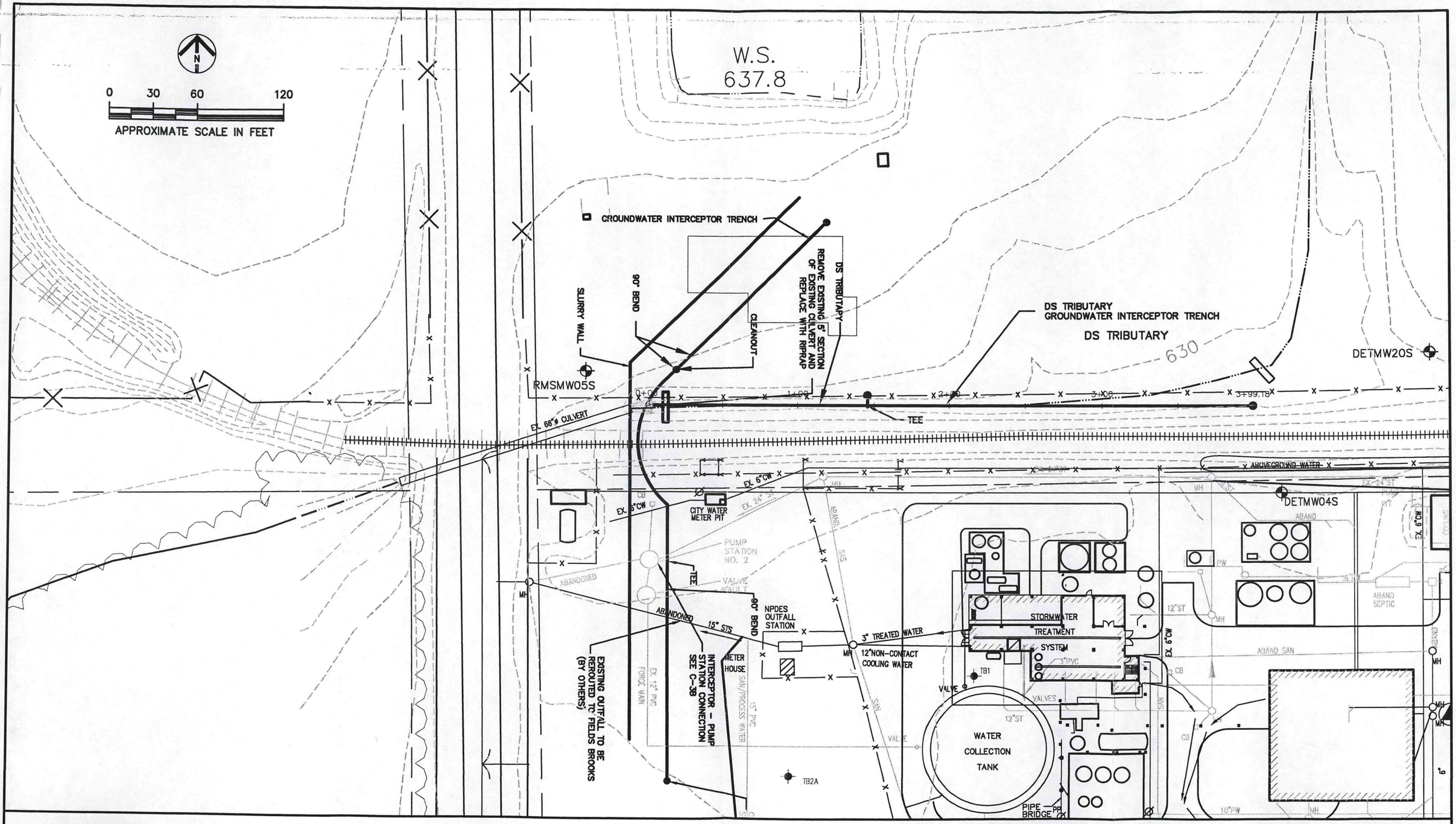

URS

PROJECT	DETREX CORPORATION	JOB NO.	13810732
SUBJECT	DS TRIBUTARY INVESTIGATION AREA	DATE	10/18/2005
		DRAWN BY	VD
SCALE	1"=60'	FIGURE	3-1

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N

0 30 60 120

APPROXIMATE SCALE IN FEET

LEGEND:

- STAFF GAUGE
- DPT
- DPT W/TEMPORARY PEIZOMETER

W.S. 637.8

GROUNDWATER INTERCEPTOR TRENCH

SLURRY WALL

90° BEND

CLEANOUT

REMOVE EXISTING 5' SECTION OF EXISTING CULVERT AND REPLACE WITH RIPRAP

DS TRIBUTARY

DS TRIBUTARY GROUNDWATER INTERCEPTOR TRENCH

DS TRIBUTARY

RMSMW05S

DST-1

DETMW20S

DST-2

DST-3

DST-4

DST-5

TEE

EX. 66"ø CULVERT

CITY WATER METER PIT

PUMP STATION NO. 2

ABANDONED

TEE

VALVE VAULT

90° BEND

NPDES OUTFALL STATION

3" TREATED WATER

12"NON-CONTACT COOLING WATER

ABANDONED 15" STS

EXISTING OUTFALL TO BE REROUTED TO FIELDS BROOKS (BY OTHERS)

INTERCEPTOR - PUMP STATION CONNECTION SEE C-3B

METER HOUSE

FORCE MAIN

SAN/PROCESS WATER

STORMWATER TREATMENT SYSTEM

WATER COLLECTION TANK

TB1

TB2A

VALVE

VALVES

PIPE BRIDGE

ABOVEGROUND WATER

DETMW04S

ABAND

ABAND SAN

ABAND SEPTIC

EX. 6"CW

EX. 24"ST

EX. 12" PVC

15" PVC

3" PVC

12"ST

10"PW

16"PW

PROJECT	DETREX CORPORATION	JOB NO.	13810732
SUBJECT	DS TRIBUTARY AREA INVESTIGATION LAYOUT	DATE	10/18/2005
		DRAWN BY	VD
SCALE	1"=60'	FIGURE	3-2

URS

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Appendix A
Standard Operating Procedure

PURPOSE AND LIMITATIONS

This standard operation procedure (SOP) provides instructions for the deployment and retrieval of passive soil gas samplers. Passive soil gas sampling is intended for the collection of volatile and semi-volatile organic vapor within the vadose zone for screening purposes. The sampling protocol described in this SOP provides a time-weighted average of contaminant concentration that may or may not correlate to actual subsurface concentration in soils or groundwater.

Collection point placement must be selected to avoid preferential pathways such as monitoring wells or utility trenches that may bias the results. A 10 to 15 foot separation distance is suggested by soil gas sampler suppliers.

Due to the proprietary nature of passive soil gas samplers, these procedures specifically address the Emflux (supplied by Beacon Environmental Services) and Gore samplers. Other samplers may require a modification of these procedures.

EQUIPMENT AND SUPPLY REQUIREMENTS

1. Equipment to lay out and mark sample locations (scaled map, measuring tapes, pin flags, GPS);
2. Soil gas samplers;
3. Disposable gloves and equipment decontamination supplies
4. Slide hammer probe (slam bar) or electric rotary hammer drill (AC power outlet or portable generator and extension cords required) with carbide tipped bits or augers.
5. Wire cutter (Emflux);
6. 3" x 4" plastic sampler bags (for return shipment of samples);
7. box of aluminum foil (Emflux);
8. Knife or scissors;
9. Vicegrips (Emflux); and
10. Plastic sheeting.

PROCEDURE

Deployment

1. At each survey point, clear vegetation as necessary and, using a hammer drill or comparable equipment, create a small-diameter hole to approximately foot depth or to the depth indicated in the work plan. Immediately after the survey point is created, a PID will be used to screen for potential vapors. PID readings will be collected for 3-5 minutes from each survey point. Results will be recorded in the field book.

2. Prepare the sampler while wearing clean gloves.

   - *Emflux Samplers* When the hole has been created, remove one of the samplers (a glass vial containing four adsorbent cartridges) and unwind the retrieval wire wrapped around it. Holding the capped end of the vial in one hand, pull the wire tight (to straighten it) with the other hand. Remove the solid cap on the sampler vial and replace it with a Sampling Cap (a one-hole cap with a screen meshing insert). Place the solid cap in the field kit supplied with the sampler.

   - *Gore Samplers* Cut a piece of the supplied cord to a length of approximately 7.0 feet. Tie the ends of the cord together using a square knot. Pass the looped cord through the eyelet in the cork and pull it back through itself. Wrap the remainder of the cord around the cork and secure the cord/cork combination with a rubber band. Remove the sampler from the numbered jar and reseal the jar. Verify that the barcode on the jar lid correspond with the serial number on the sampler. Attach the cord and cork to the module by passing the looped cord through the loop on the module and pull the cord/cork back through itself.

3. Insert the sampler in the hole. The sampler is suspended in the upper six-inches of the hole regardless of the depth of the hole.

   - *Emflux Samplers.*

     i) Lower the sampler with the capped-end pointing down the hole to a depth of approximately six inches.
     ii) Bend the wire above the hole and firmly hold onto the wire so the Sampler does not fall into the hole. [Note: It is often helpful to stake the wire outside the hole so it will not fall in.]
     iii) Take a compressed plug of aluminum foil and ***tightly*** plug the top of the hole so that the foil rests approximately 1/2-inch below the ground surface.
     iv) Bend the wire over the aluminum foil plug, once again making sure that the Sampler is secure so it will not fall into the hole.
     v) Collapse the soils above the aluminum foil plug. Coil the remaining wire that extends from the hole and flatten it on the ground surface. **[Note:** The wire is useful in locating the sampler during retrieval.].

   - *Gore Samplers*

     vi) Place the insertion rod into the precut pocket at the base of the module and lower it into the hole. If you encounter resistance remove the module and ream the hole and reinsert the module.
     vii) Once deployed to the desired depth, press the insertion rod against the side of the hole and twist slightly to release the module.
     viii) Remove the rod and push any excess cord into the pilot hole and plug it with the cork

4. In the field book record: (a) sample-point number; (b) date and time of emplacement (to nearest minute); and (c) other relevant information (e.g., soil type, vegetation, proximity to

potential source areas). Mark the sample location and take detailed notes to facilitate later recovery of the sampler.

Retrieval

1. Sampler retrieval is conducted after a sufficient time has elapsed for the samplers to equilibrate with the soil gas. For clayey soils, this requires approximately 10 days.

2. Remove the sampler.

   - *Emflux.* Remove the aluminum foil plug, using vise grips and the scratch awl, if necessary, and retrieve the sampler from the hole. Holding the sampler upright, clean the sides of the vial with the clean towel (especially around the container threads). Remove the sampling cap, cut the wire from the vial with the wire cutters, and clean the vial threads completely with the supplied gauze cloth. [**Note: Completely remove the wire to ensure the cap fits tight on the vial and no soil is returned in the field kit.**]

   - *Gore.* Remove the cork with a knife or awl. Grasp the cord and pull the module from the ground. Cut off and discard the cork and cord.

3. Seal the sampler in its storage container. Clean any soil/debris from the threads of the jar and lid, and make sure no part of the sampler is pinched between the jar and lid. Be sure the seal is tight. Use caution when screwing down the lid on the sample jars. Over tightening may cause breakage.

SHIPMENT

Samples are returned to the supplier at the completion of the field effort in their supplied containers. Standard chain of custody procedures are to be followed. Samples do not require ice for preservation.